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## Which is the fastest supercomputer on earth?

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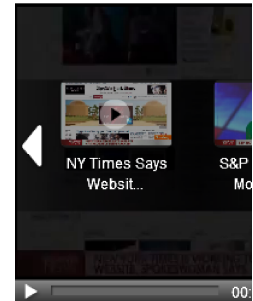
### MDGrape-3

The world's fastest supercomputer will probably never be known as the world's fastest supercomputer. RIKEN's MDGrape-3 is the first machine to break the petaflop barrier -- that's 1 quadrillion calculations (floating-point operations, to be specific) per second -- and it's three times faster than the currently ranked fastest computer in the world, IBM's BlueGene/L. But MDGrape-3 is so specialized that it can't run the software used to officially rank computing speed. What it can do is determine the effect of any chemical compound on one of the most intricate systems in the human body in a couple of seconds. MDGrape-3 is designed for pharmaceutical research, specifically molecular dynamics simulation. In developing drugs, pharmaceutical companies have to analyze thousands on thousands of chemical compounds to find out how they'll affect the protein-bonding structures in the human body. Protein structures called enzymes are the building blocks that do all of the work within a cell, and the way these proteins bond with any drug compound introduced into the human body determines the body's response to that drug. MDGrape-3 produces simulations of these molecular interactions. What takes most computers hours or days to analyze takes MDGrape-3 a few seconds. This functionality is invaluable in drug research, and it could drastically cut the research time involved in the development of new cures. A subsidiary of pharmaceutical giant Merck has already booked time on the machine.

Structurally speaking, MDGrape-3 is a parallel computing system consisting of two main sections: a primary server unit and a specialized-engines unit. The latter component is a cluster of 201 engines running proprietary chips developed by Riken specifically for MDGrape-3. It's this huge set of engines, running 24 MDGrape-3 chips each, that does the heavy protein-analysis lifting. Each chip has a maximum processing speed of 230 gigaflops (one billion operations per second). The primary server unit manages the engine cluster. This parallel server setup runs two different types of processors: 65 servers run dual-core Intel 5000-series Xeon processors, 256 per server; and 37 servers run 3.3-GHz Intel Xeon processors, each with 2 MB of level 1 cache, at 74 processors per server. This hardware structure enables the 1-petaflop speed, which is the machine's theoretical maximum for certain processes.

MDGrape-3 took \$9 million and about four years to build. And it's actually very efficient -- a total cost of \$9 million breaks down to about \$15 per gigaflop. The slower BlueGene/L cost about \$140 per gigaflop to build.

BlueGene/L, which tops out at a theoretical 360 teraflops (trillion calculations per second), is also a biotechnology-specific machine. The advances in speed marked by these two supercomputers is indicative of a general trend in technology toward biologically-slanted systems. Some say the trend really started with the successful mapping of the human genome in 2000. Regardless of what spurred the current biotechnology race, most experts agree that the logical end of the surge is a state of DNA-based medicine. In several decades, we could make an appointment with our doctor for a quick DNA analysis to find out what diseases we're at risk for and pop a single, gene-targeting pill that eliminates all of those foreseeable risks.



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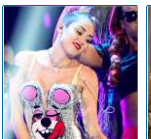


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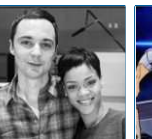
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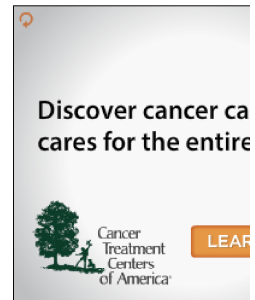
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